Bill Nye the Science Guy

Garbage

Table of Contents

1. Implementation Guide 2-9

This descriptive guide will assist you in integrating the DVD science and education content into your instructional program.

2. National Science Education Standards 10

See the complete *National Science Education Standards (NSES)* correlated for this program.

3. Episode Guide 11

Step-by-step procedures make it easy to complete the experiments shown in the program. "More Interesting Stuff to Do" gives more experiments that extend student learning.

4. Lesson Planning Worksheet 12-13

This template helps you incorporate all the features of the Bill Nye DVD into your daily lesson plans.

5. Student "Know / New" Chart 14

A "Know-New" T-Chart assesses students' prior knowledge and what they learned.

6. Student Recording Sheet 15

This handout gives you a standardized format that students can fill out as they conduct an experiment.

7. Glossary 16-18

Use the terms and definitions found here to assist you in direct vocabulary instruction. The glossary terms are also found on the DVD.

8. Quiz 19

This written version of the interactive quiz on the DVD provides a ready-to-go written test. Multiple choice and true-false items address key concepts found in the standards and in the program.

9. Quiz Answer Key 20

A separate page contains the quiz answer key.

©Disney

Implementation Guide

Welcome to Disney's Bill Nye DVD collection!
With the help of this Guide you can bring instructional DVDs into your science curriculum.

What's on the DVD?

Bill Nye DVDs expand the educational features of *Bill Nye the Science Guy* programs. Each DVD provides students with science content through video clips aligned with *National Science Education Standards (NSES)* and a host of other resources.

Short video clips aligned with the NSES provide a unique opportunity for you to enhance your lessons using DVD technology. Now you can show a video clip, or even short segments of a clip, on command. But there are a host of other features, too! See the chart below for a summary.

From the Main menu, there are three chief sections:

Feature	Description
Watch Program Menu	From this menu, you can play the program straight through or use the clips to customize your viewing.
Teacher Support	From this menu, you can access this Teacher's Guide, the Glossary, Internet Links, and the Quiz.
Bonus Materials	Use this menu to try a different discussion starter, download a special screen-saver, or check out never-before-seen footage.

From the Watch Program menu, you can:

Feature	Description
Play Program	Play the entire program from start to finish.
Bilingual Mode	View the entire program or clips in English or Spanish.
Glossary Mode	Make links to Glossary terms appear during the program.
Program Overview	View the program introduction, in which Bill discusses the topic covered.
Try This	Show students demonstrating science concepts.
Way Cool Scientist	Meet a real scientist who talks about his or her area of study.
Bill's Demonstration	Look at a science demonstration conducted by Bill Nye.
Music Video	Enjoy a short music video that summarizes the topic in an age-appropriate and entertaining manner.
Science Standards	Take advantage of short video clips from the program, which are aligned with National Science Education Standards.

©Disney

From the Teacher Support menu, you can:

Feature	Description
Science Quiz	Give students a quiz to take independently or as a class. Seven to ten quiz items are aligned with the National Science Education Standards. The items are in multiple-choice or true-false format. Each wrong answer links to a standards-aligned video clip. At the end of the quiz, a scoring function reveals the number of correct initial answers.
Glossary	Check out definitions of key terms and view video clips that reinforce the concepts.
DVD Features	View a quick overview of the features found on the DVD.
Teacher's Guide	Print out or view this comprehensive Teacher's Guide in PDF format.
Internet Link	Link to the Bill Nye area of Disney's Edustation Web site, where you can find links to Internet sites related to the content of each Bill Nye program.

From the Bonus Materials menu, you can:

Feature	Description
Bonus Material	Find out what *wasn't* in the episode! In most cases, there's more of the Way Cool Scientist interview, Bill Nye outtakes, and an extra discussion starter.
Additional Clips	See trailers of related DVDs and videos.
Screen-Saver	Download this cool screen-saver for your computer.

The Planning Process

This Guide provides a Lesson Planning Worksheet (see page 12), which can assist you in setting up your instruction around a topic. The following sections of this Implementation Guide are offered to assist your planning process:

- **Determining Objectives and Linking to Standards**
- **The Learning Cycle**
  - **Explore**
  - **Apply**
  - **Extend**
  - **Assess**

Science Rules!

©Disney

Determining Objectives and Linking to Standards

1. The NSES Teaching Standard A states that science teachers must "select science content and adapt and design curricula to meet the interest, knowledge, understanding, abilities, and experience of students."

   The NSES recommends that teachers "integrate . . . a practical structure for the sequence of activities, and the content to be learned." The primary instructional model recommended by the NSES is inquiry into authentic student-generated questions about natural or designed phenomena. Since most state and local standards documents were derived from the NSES, you will find that your local and state standards match closely with content standards in the Bill Nye DVD.

   Each DVD contains a menu of clips that are aligned with the NSES. You can review the standards and their aligned clips in the Science Standards menu under Watch Program. Also, the Standards listed on page 10 of this Guide allow you to look at additional NSES content standards that are addressed on the video. Here's an example of the content standards and clips aligned with the Bill Nye DVD entitled *Blood and Circulation*:

Life Science Standards (NSES) Addressed in *Blood and Circulation*

Life Science:
Structure and function in living systems

- **Living systems at all levels of organization demonstrate the complementary nature of structure and function.**

  Aligned clips:

  - **1 Blood vessels**
  - **2 Heart pump and bloodstream**
  - **3 Heart valves and blood circulation**
  - **4 White blood cells**
  - **5 Capillaries**

- **The human organism has systems for digestion, respiration, reproduction, circulation, excretion, movement, control, and coordination, and for protection.**

  Aligned clips:

  - **6 Heart pump**
  - **7 Heart muscle**
  - **8 Pumping blood to brain**

©Disney

2. Determine your objectives for the lesson and how these objectives address the standards.

Sample Objectives for *Blood and Circulation*

In this activity students will:

- **Observe and describe a body system responsible for supply and transport.**
- **Use this information to define a body system.**
- **Ask questions about the circulatory system.**
- **Explain how structure complements function in organs of the circulatory system.**
- **Cite examples of current research related to this system.**

3. Design a learning cycle of instructional experiences and assessments for the students to engage in that will help students meet these standards. Students may be given teacher-planned investigations or may be guided to design their own investigations.

The Learning Cycle

The learning cycle is a sequence of activities that involve students in the learning process. The sequence found here is based on research from Lawson, Abraham, and Renner published in 1989. That has been adapted to include: Explore, Apply, Extend and Assess:

Explore:	Involves assessing students' prior knowledge and providing opportunities for students to interact with content from the video.
Apply:	Includes having students use the content learned during the Explore section in a new way that is meaningful to future learning.
Extend:	Allows students to conduct further research around an area of interest within the topic.
Assess:	Provides strategies meant to inform students and teachers about the content and processes that have been learned.

Explore

The NSES Teaching Standard B states: "Teachers of science guide and facilitate learning." This standard addresses the constant need to balance your predetermined goals with allowing students to set and meet their own learning goals.

Focus and Support Inquiries: Support student inquiries by making decisions about "when to provide information" and "when to connect students with other sources." Knowing the best time to intervene is often determined by allowing students to ask questions and to explore concepts openly.

©Disney

The NSES Teaching Standard C states: "Teachers of science engage in ongoing assessment of their teaching and of student learning."

Assess in Order to Guide Teaching: The Program Overview or the Discussion Starter on the DVD can be used to gauge students' prior knowledge. You can use student responses to make decisions about appropriate instruction and adaptations in order to meet the needs of individual students. Assessment can be in the form of student reflections from standards-aligned video clips or answers to questions found on the science quiz. Or, as in the following example, a simple graphic organizer can facilitate a formative assessment.

Example: T-Chart from *Blood and Circulation*

1. Ask students to fill out the "Know-New" T-Chart (see page 14). Have them list what they already know about the circulatory system (heart, blood vessels, blood, etc.) on the left side of their charts.

2. Show the Program Overview for *Blood and Circulation.* On the right side of the chart, have students list new things they have learned from watching the clip. Walk around the room and assist students in filling in their T-Charts. Replay the program as necessary to allow students to review sections of interest.

3. Once students have completed their charts, ask them to share what they have listed in the "New" column. Write these on the board. Have students write their own working definitions of the circulatory system. Once students have completed their definitions, collect and review their work to assess prior knowledge.

Conduct direct vocabulary instruction in the Explore phase. Research suggests that:

- Students must encounter words in context more than once to learn them.
- Instruction in new words enhances learning those words in context.
- One of the best ways to learn a new word is to associate an image with it.
- Direct vocabulary instruction on words that are critical to new content produces the most powerful learning.

Use the DVD Glossary with the linked video clips to expose students to new vocabulary words in context, along with associated video images. You can also find a printed version of the glossary terms in this Guide on page 16.

©Disney

Example: Using the Glossary for Direct Vocabulary Instruction
Blood and Circulation

1. Present students with a brief explanation or description of the new term or phrase from the glossary. For example: "Capillary: A small blood vessel that connects arteries and veins."
2. Present students with a nonlinguistic representation of the new term or phrase. Show the video clip associated with the term "capillary."
3. Ask students to generate their own verbal description of "capillary."
4. Ask students to create their own nonlinguistic representation of "capillary."
5. Periodically ask students to review the accuracy of their explanations and representations. This can be done after the Apply activities.

Apply

Based on the information you gained from the Explore assessments, design appropriate activities for your students. Check the experiments listed in the Episode Guide (see page 11) for explanations of the demonstrations from the Bill Nye program as well as for additional experiments designed to help apply the knowledge gained.

In the following example from *Blood and Circulation*, the standards-based video clips provide background information, and an experiment from the Guide helps students apply what they have learned about arteries and veins.

Example: The Structure and Function of Arteries and Veins

1. Have students begin "Know-New" T-Charts, focusing on what they already know about the structure and function of blood vessels, arteries, and veins.
2. Watch the following chapters from the Bill Nye DVD *Blood and Circulation*:
   - Blood vessels
   - Heart pump and bloodstream
   - Capillaries
3. Complete the "Know-New" T-Charts.
4. Give students copies of the Student Recording Sheet (see page 15) and have them fill the sheets out as they conduct their experiments.
5. Do the experiment entitled "Pump it Up!" from the *Blood and Circulation* Episode Guide, in which students observe the apparent effects of pressure on arteries and veins.
6. Write down any remaining questions about the structure and function of blood vessels, arteries, and veins.

©Disney

Extend

The NSES Teaching Standard D states: "Teachers of science design and manage learning environments that provide students with the time, space, and resources needed for learning science." School administrators, parents, and the community can assist teachers in providing local resources that make science lessons pertinent and meaningful.

Identify and Use Resources Outside of the School: "The school science program must extend beyond the walls of the school." Each Bill Nye DVD contains resources designed to facilitate such understanding, including:

- Way Cool Scientist, found in both Watch Program and Bonus Materials, in which scientists discuss their current areas of study. This real-world connection often results in a deeper student understanding of a particular career.
- Disney's Edustation Web site, where relevant Internet links provide a starting point for students to further explore science topics.
- Try these video clips, with activities parents and students can do at home. The questions generated by students from these experiences can be used as foundations from which they may conduct their own research.
- Standards-aligned video clips and Bill's demonstration video clips, which can help generate topics for further research. After viewing the clips, have students list their questions, perhaps about the most current developments in a topic. By conducting online or library research, students will find answers to their questions and will learn about a topic in greater depth.

Example: Conducting Student Research Using *Blood and Circulation*

Ask students to choose one of the questions they had after completing the activities from *Blood and Circulation*. An example of a student research question might be, "How has the technology related to artificial hearts advanced in the last ten years?" Explain to students that they will be conducting research to find answers to their questions. Some students may want to complete online or library research, others may want to ask an expert in the field, while others may want to design and conduct a scientific investigation. Encourage students to write a detailed procedure for finding answers to their questions. Ask students to find one or more examples of current research dealing with the circulatory system that is related to their question. NOTE: Students with similar questions may work together to complete the assignment.

©Disney

Assess

Once students have conducted the research, you may choose to assess them in a number of different ways:

- By having students write about what they learned in a journal.
- By having students submit projects or reports.
- By having students take the program quiz to gauge their understanding of certain facts in the video. You can either print the quiz (found in this Guide on page 18) and have each student complete it individually or use the DVD screen version and the scoring feature for whole-class assessment.
- By designing other standards-aligned questions to augment those that are provided.

While the quiz will provide you with information about what the students have learned, it does not assess how students have processed the information. Below you will find assessment ideas that can be used to measure both content and process.

A Sample Assessment for *Blood and Circulation*

1. Explain to students that an important aspect of scientific inquiry is to communicate findings to others. In this assessment, students will present the following information to their peers:
    - The question they investigated.
    - The method that was used to find answers to their question.
    - Problems or successes during the search.
    - Answers to their question.
    - Current research related to their question.
    - New questions that have arisen.
2. Distribute the rubric found in the Lesson Planning Worksheet (see page 13) to students so they know how they will be assessed. Make sure students understand the criteria found in the rubric. Before you begin, you may want to allow students to make changes to the rubric so that it is clearer or makes more sense from their perspectives.
3. Allow students time to gather information to answer their questions and to prepare for their presentations. As students conduct this work, walk around the room and ask questions to assess their progress and provide input as needed.
4. Take a few minutes to clarify the rules of the presentation with the students. You may want to have multiple copies of the rubric available so that peers can rate the presentations.
5. As presentations are made, assess the quality of the student's work as thoroughly and as equitably as you possibly can.

Congratulations! You have now completed the steps to set up a lesson plan using the Lesson Planning Worksheet. You have also explored many of the features of the Bill Nye DVD as well as the supplemental information found in this Teacher's Guide. And most important, you've made significant strides toward incorporating DVD technology into your day-to-day instruction.

©Disney

National Science Education Standards

Garbage

Standards/Benchmarks – Grades 5-8

Life Science

Populations and ecosystems

- Populations of organisms can be categorized by the function they serve in an ecosystem. Plants and some micro-organisms are producers—they make their own food. All animals, including humans, are consumers, which obtain food by eating other organisms. Decomposers, primarily bacteria and fungi, are consumers that use waste materials and dead organisms for food. Food webs identify the relationships among producers, consumers, and decomposers in an ecosystem.

Science and Technology

Understandings about science and technology

- Scientific inquiry and technological design have similarities and differences. Scientists propose explanations for questions about the natural world, and engineers propose solutions relating to human problems, needs, and aspirations. Technological solutions are temporary; technologies exist within nature and so they cannot contravene physical or biological principles; technological solutions have side effects; and technologies cost, carry risks, and provide benefits.

- Perfectly designed solutions do not exist. All technological solutions have trade-offs, such as safety, cost, efficiency, and appearance. Engineers often build in back-up systems to provide safety. Risk is part of living in a highly technological world. Reducing risk often results in new technology.

- Technological solutions have intended benefits and unintended consequences. Some consequences can be predicted, others cannot.

Science in Personal and Social Perspectives

Populations, resources, and environments

- Causes of environmental degradation and resource depletion vary from region to region and from country to country.

Natural hazards

- Human activities also can induce hazards through resource acquisition, urban growth, land-use decisions, and waste disposal. Such activities can accelerate many natural changes.

History and Nature of Science

Science as a human endeavor

- Women and men of various social and ethnic backgrounds—and with diverse interests, talents, qualities, and motivations—engage in the activities of science, engineering, and related fields such as the health professions. Some scientists work in teams, and some work alone, but all communicate extensively with others.

- Science requires different abilities, depending on such factors as the field of study and type of inquiry. Science is very much a human endeavor, and the work of science relies on basic human qualities, such as reasoning, insight, energy, skill, and creativity—as well as on scientific habits of mind, such as intellectual honesty, tolerance of ambiguity, skepticism, and openness to new ideas.

©Disney

Episode Guide

Garbage

Nifty Questions in This Episode	Awesome Answers
How much garbage does a person produce each day?	Each person produces two kg of garbage every day!
Do plants make waste?	Yes. All living things produce waste (plants and animals).
What is the volume of waste generated by nature each year?	Nature generates 20 centimeters of waste per year. Humans create this much in a week!

Experiments shown on the video:

BREAKING DOWN

Objective: To show how nutrients for plants are made.

- Drive four to six sticks (1 meter in length) into the ground. Space the sticks 1/2 meter apart.
- Wrap chicken wire around the outside of the sticks, forming a circle.
- Place grass, leaves and vegetation in the center inside the wire. Observe for several weeks, adding water and stirring occasionally.
- Compost will be produced.

LIFE IN A BOTTLE

Objective: To create a small greenhouse.

- Cut around the top of a 2-liter plastic bottle, leaving 2 centimeters attached to act as a hinge.
- Place soil in bottom of bottle.
- Put seeds, small plants, flowers, etc., in bottle and add water to create a small greenhouse.
- Place the plastic bottle in the sun.
- The waste from decomposing leaves and vegetation will replenish the soil's nutrients.

More interesting stuff to do:

AIR APPARENT . . . NOT

Objective: To demonstrate that there is pollution in the atmosphere.

- Place one jar lid on each of four pieces of paper.
- In each different lid, place one cotton ball, one cotton ball with three drops of turpentine, a piece of wool, and a piece of Styrofoam.
- Cover each lid with a 600-milliliter beaker.
- Have your teacher light each substance (one at a time) and cover with the beaker. Observe for 2 minutes after the flame goes out.
- Record your observations on a chart (color, odor, etc.).

MASS THE TRASH

Objective: To determine the amount of garbage generated by humans.

- At home, weigh on a bathroom scale and record the total amount of garbage produced after each meal.
- Then separate and weigh glass, plastic, aluminum and/or metal items. Record results.
- Weigh food waste separately. Record results.
- Create a bar graph to display the results. What conclusions can be drawn?
- Record each family member's garbage. Who is the most environmentally friendly?

©Disney

Bill Nye the Science Guy

Lesson Planning Worksheet

Lesson Title

Objectives ______________________________

____

____

Estimated Time Required ______________________________

Materials Needed ______________________________

____

National Science Educational Standards

____

____

____

____

____

Explore ______________________________

____

____

____

Apply ______________________________

____

____

____

Extend ______________________________

____

____

____

©Disney

Assess

As presentations are made, assess the quality of the student's work as thoroughly and as equitably as you possibly can. The following criteria can be used to assist in your assessment.

Name of Student ______________________________

Question Investigated ______________________________

Initial Question			
1 Question is broad and not well defined	2 Question is defined but limited to single-answer responses.	3 Question is clear and might elicit multiple responses that may lead to new ideas and additional questions.	4 Question is engaging and provokes new ways of thinking about an issue.
Methods for Finding Answers			
1 Students do not share planned or actual methods.	2 Students share methods but they are unclear or vague.	3 Students share methods but not the problems or successes of using the methods.	4 Students share methods and problems or successes in using the methods.
Results			
1 Student results are undefined.	2 Student results are incomplete and do not adequately answer the question.	3 Student results are complete, adequately answer the question, and include current research related to the question.	4 Student results are complete, include current research, and have resulted in one or more additional questions.
Communication			
1 Student is not prepared to speak.	2 Presenter has distracting mannerisms and avoids eye contact with the audience.	3 Presentation is clean and clear with some eye contact and very few distractions.	4 Presentation is exceptional and unique. Presenter uses regular eye contact and avoids distractions.

© Disney

Bill Nye the Science Guy

Student "Know / New" Chart

Know	New
Write down what you know about the topic of the video.	Write down information from the video that is new to you.

©Disney

Bill Nye the Science Guy

Student Recording Sheet

Name **Date**

Title of Experiment

Question: (What are you testing?)

Procedure: (Describe the experiment)

Materials: (List what you used)

Observations: (Record what happened)

Results: (Make your own data table)

Conclusions: (Use your observations and results to describe what you learned)

©Disney

Glossary

Garbage

Fold and cut to use as flashcards.

Bill Nye the Science Guy

NON-BIODEGRADABLE WASTE

Non-biodegradable waste

This is waste that does not breakdown or decompose through natural processes such as bacterial action. Examples are plastic items, glass, tin cans, and concrete.

Bill Nye the Science Guy

NATURAL WASTE

Natural Waste

Waste produced by nature. Generally, these wastes are biodegradable and are reintroduced into the environment through natural recycling processes. An example would be dry leaves in a forest that decompose and become part of the soil.

Bill Nye the Science Guy

COMPOST

Compost

A product resulting from the biological breakdown or decomposition of organic (natural) materials such as leaves, grass clippings, yard trimmings, fruits, and vegetables. It is dark, odorless, and rich in nutrients, and is commonly used as a soil conditioner or fertilizer.

©Disney

Fold and cut to use as flashcards.

Bill Nye the Science Guy

DECOMPOSING MICRO-ORGANISMS

Decomposing Micro-organisms

All micro-organisms involved in breaking down and decomposing organic material. Bacteria are the primary decomposing micro-organisms.

Bill Nye the Science Guy

BIODEGRADABLE WASTE

Biodegradable Waste

Any waste that is capable of being broken down and decomposed under anaerobic (in absence of air) or aerobic (in air) conditions. In general, biodegradable wastes are organic, natural materials that contain fats, carbohydrates, or proteins. Examples are food waste, garden waste, and animal waste. Decomposition occurs as a result of bacterial action.

Bill Nye the Science Guy

LANDFILL

Landfill

A disposal site for solid wastes on land. Wastes are deposited and compacted. The waste is covered with a layer of soil, and the process of deposit and compaction is repeated. The purpose is to confine the wastes to the smallest practical area and volume without creating hazards.

©Disney

Fold and cut to use as flashcards.

Bill Nye the Science Guy

LEACHING

Leaching

The process by which liquids, usually rain and surface water, are carried down through the soil, dissolve, and then release substances from the soil. Some landfills have anti-leaching barriers that prevent fluids from leaving the landfill.

Bill Nye the Science Guy

TERRARIUM

Terrarium

A glass container in which selected living plants are kept and observed. The conditions inside, such as high humidity, can be adjusted to meet the needs of particular species of plants.

Bill Nye the Science Guy

NET WEIGHT

Net Weight

The weight of an item alone without any wrappings. The weight of the amount of product in a container. If one weighs a can of tomato juice, then empties out the juice and weighs the empty can, the net weight of tomato juice is obtained by subtracting the can weight from the total weight.

Science Rules!

©Disney

Name ____________________ Date ____________

Quiz

Garbage

True or False? Circle T or F

1. Humans are the only living things that create waste. T or F
2. People in the United States create trash at the rate of 2 kg/person/day. T or F
3. The forest builds up trash at the same rate that humans do. T or F
4. Humans are the only species that make non-biodegradable waste. T or F
5. In the largest garbage dump in the world, most of the garbage is plastic bags. T or F
6. It will take the same amount of work to clean up our planet later as it takes to clean it up now. T or F
7. We can choose to reduce, reuse, and recycle our waste. T or F

Multiple Choice: Circle the letter of the best answer

8. Which of the following should you put into a compost pile?
   A. Food wastes
   B. Yard wastes
   C. Both food and yard wastes
   D. Neither food nor yard wastes

9. Which of the following statements regarding trash is correct?
   A. Nature builds up about 20 centimeters meters of trash per day in a forest.
   B. Humans put about 20 centimeters of trash in a typical landfill every year.
   C. Humans put about 20 centimeters of trash in a typical landfill every week.
   D. None of the above answers are correct.

10. Which of the following statements regarding the waste humans make is correct?
    A. Potato peelings, chicken bones, and paper are biodegradable.
    B. Plastic bags and soft drink bottles are not biodegradable.
    C. Forty percent of the trash that goes into landfills is paper.
    D. All of the above are correct.

©Disney

Answer Key

Garbage

1. F
2. T
3. F
4. T
5. T
6. F
7. T
8. B
9. C
10. D

BIODEGRADABLE WASTE

TERRARIUM

©Disney